UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
BIN C15700
Seattle, WA 98115-0070

July 27, 2002

Lieutenant Colonel Richard P. Wagenaar
District Engineer
Department of the Army
Corp Of Engineers
Walla Walla District
201 North Third Avenue
Walla Walla, Washington 99362-1876

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Dredged Material Management Plan for the McNary Reservoir and Lower Snake River Reservoirs (NMFS No. WSB-01-301).

Dear Colonel Wagenaar:

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.) and the Magnuson Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, the attached document transmits the National Marine Fisheries Service's (National Oceanic and Atmospheric Administration (NOAA) Fisheries) Biological Opinion (BO) and MSA consultation on the implementation of the Dredged Material Management Plan for the McNary Reservoir and Lower Snake River Reservoirs. The Army Corps of Engineers (COE) determined that the proposed action was likely to adversely affect the ESA listed Evolutionarily Significant Units (ESUs) of endangered Snake River (SR) sockeye (*Oncorhynchus nerka*), threatened Snake River fall (SRF) chinook (*O. tshawytscha*), threatened Snake River spring/summer run (SRSS) chinook (*O. tshawytscha*), threatened Snake River Basin (SR) steelhead (*O. mykiss*), endangered upper Columbia River spring-run (UCRS) chinook (*O. tshawytscha*), endangered upper Columbia River (UCR) steelhead (*O. mykiss*), and threatened middle Columbia River (MCR) steelhead (*O. mykiss*).

This BO reflects the results of a formal ESA consultation and contains an analysis of effects covering the ESUs listed above in the Columbia and Snake Rivers. The BO is based on information provided in the Biological Assessment (BA) and associated addenda sent to NMFS by the COE, and additional information transmitted via telephone conversations, fax, and e-mail. A complete administrative record of this consultation is on file at the Washington Habitat Branch Office.

The NOAA Fisheries concludes that implementation of the proposed project is not likely to jeopardize the continued existence of the previously noted ESUs or result in destruction or adverse modification of designated Critical Habitat. In your review, please note that the incidental take statement, which includes Reasonable and Prudent Measures and Terms and Conditions, were designed to minimize take.

The MSA consultation concluded that the proposed project may adversely impact designated Essential Fish Habitat (EFH) for chinook and coho salmon. The Reasonable and Prudent Measures of the ESA consultation, and Terms and Conditions identified therein, would address the negative effects resulting from the proposed COE actions. Therefore, NOAA Fisheries recommends that they be adopted as EFH conservation measures.

If you have any questions, please contact Mr. Dale Bambrick of the Washington Habitat Branch, Ellensburg Field Office at (509) 962-8911.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

Enclosure

Endangered Species Act - Section 7 Consultation

Biological Opinion

And

Magnuson-Stevens Fishery Conservation and Management Act

Essential Fish Habitat Consultation

On the Dredged Material Management Plan for the McNary Reservoir and Lower Snake River Reservoirs
WSB-01-301

Action Agency: Department of the Army, Corps of Engineers

Consultation
Conducted By: National Marine Fisheries Service
Northwest Region
Washington State Habitat Branch

Issued by: for Michael R Crouse
D. Robert Lohn
Regional Administrator

Date Issued: July 30, 2002

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1.0 INTRODUCTION

This document is the product of an Endangered Species Act (ESA) Section 7 formal consultation and a Magnuson-Stevens Fishery Conservation and Management Act (MSA) Essential Fish Habitat (EFH) consultation between the National Marine Fisheries Service (National Oceanic and Atmospheric Administration (NOAA) Fisheries) and the Army Corps of Engineers (COE). The subject of these consultations is the COE's proposed implementation of a dredge materials management plan (DMMP) within an action area including reservoirs of the Lower Snake River (SR) (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite reservoirs) and the Columbia River (CR) (McNary Reservoir).

The action area encompasses portions of the habitat occupied by the ESA listed Evolutionarily Significant Units (ESUs) of endangered SR sockeye (*Oncorhynchus nerka*), threatened Snake River fall (SRF) chinook (*O. tshawytscha*), threatened Snake River spring/summer run (SRSS) chinook (*O. tshawytscha*), threatened Snake River Basin (SRB) steelhead (*O. mykiss*), endangered upper Columbia River spring-run (UCRS) chinook (*O. tshawytscha*), endangered Upper Columbia River (UCR) steelhead (*O. mykiss*), and threatened Middle Columbia River (MCR) steelhead (*O. mykiss*). This document analyzes the anticipated biological effects of navigation and maintenance dredging, disposal of associated dredged material, and raising the elevation of existing levees near the cities of Lewiston and Clarkston.

1.1 Background Information

Maintenance of the navigation channel, associated port facilities, and water based recreation facilities in the action area requires nearly chronic dredging. The DMMP represents an attempt on the part of the COE to describe not only dredging proposed for 2002 and 2003, but to anticipate the nature, intensity and magnitude of such work that will likely be required over the next 20 years. Significantly, the DMMP also proposes an assessment of the potential use of dredge spoils to improve habitat for listed fish, primarily SRF chinook.

1.2 Consultation History

The COE originally requested informal consultation on the DMMP on September 26, 2000. In their consultation request, the COE presented an effect determination of *may affect, not likely to adversely affect*. The NOAA Fisheries did not concur with the effect determination and indicated that formal consultation (*may affect, likely to adversely affect*) would be appropriate given the scope of the proposal and the potential impacts to listed species. The COE subsequently requested formal consultation on June 27, 2001. Formal consultation was initiated on September 27, 2001, and COE and NOAA Fisheries continued to meet in person and by phone throughout the fall and early winter. During the course of these discussions, the COE requested receipt of a Draft Biological Opinion (DBO) by the end of January, 2002. NOAA Fisheries provided a DBO to the COE on February 1, 2002.

Subsequent meetings and conversations between the COE and NOAA Fisheries helped refine the draft and led to modifications to the action originally proposed. At a meeting on April 22, 2002, the COE informed NOAA Fisheries that it was considering the possibility of adding an additional dredge spoil disposal location and substantially modifying the manner of disposal.

Previous proposals had featured the potential beneficial use of dredge spoils to enhance riparian conditions by adding spoils to the river bank. The new proposal would entail creating a shelf with the river to support riparian vegetation at a site (Chief Timothy Habitat Management Unit) not described in the COE DMMP Biological Assessment (BA). On May 30, 2002, NOAA Fisheries received an addendum (COE, 2000) which formally proposed adding these changes to the proposed action. Henceforth, the BA and the 30 May addendum will be collectively noted as the BA.

The objective of this consultation is to determine whether the DMMP, and subsequent DMMP operations, are likely to jeopardize the continued existence of the aforementioned listed ESUs, or result in the destruction or adverse modification of their designated Critical Habitat.

The formal consultation process involved reviewing information contained in the BA, correspondence and communication between NOAA Fisheries and the COE (numerous phone calls, meetings, and emails), and visiting the project sites. The complete administrative record is available at the NOAA Fisheries Washington State Habitat Branch Office.

1.3 Description of the Proposed Action

A complete description of the proposed DMMP is included in the COE BA. The following paragraphs describe the primary project elements relevant to ESA listed species.

The DMMP consists of two major elements: (1) DMMP operations scheduled for 2002-2003 and (2) a 20 year conceptual plan. The DMMP operations scheduled for 2002-2003 encompass maintenance and navigation dredging, dredge material disposal, and monitoring activities. The 20 year conceptual plan includes several studies that will commence prior to dredging operations that are beyond the 2002-2003 schedule. Additionally, the 20 year plan covers levee construction and provides a basic framework for future DMMP activities and ESA consultations.

1.3.1 DMMP Operations for 2002-2003

1.3.1.1 Navigation and Maintenance Dredging

The COE proposes to dredge the navigation system on the lower Snake and Columbia Rivers to attain a minimum depth of 14 feet within the navigation channel. Additionally the COE would dredge areas associated with ports, recreational facilities, and irrigated wildlife habitat management units (HMU). The locations and quantities of materials to be dredged are listed in Table 1.

The majority of the dredging would employ mechanical devices (e.g., clamshell, dragline, backhoe, or a shovel/scoop). However, hydraulic dredging equipment would be used at HMU irrigation intakes and other near shore locations. Hydraulic dredging would be appropriate only where environmental conditions are such that listed fish are not likely to be in the affected area (i.e., water temperatures that exceed 70 degrees Fahrenheit). The efficacy and impacts of the different types of dredging equipment are discussed in Section 2.1.3.

Most dredging would occur during the established in-water work windows (December 15 through March 1 in the Snake and Clearwater Rivers, and December 1 to March 31 in the Columbia River). Some small scale dredging (i.e., boat basins, swim beaches, and irrigation intakes) could occur during the summer and fall in areas where listed fish are expected to be absent if water temperatures exceed 70 degrees Fahrenheit.

Dredging operations in the navigation channel would last between 10 and 24 hours per day, six to seven days per week. Dredging may be staged in multiple shifts as necessary to ensure that dredging operations are completed within the appropriate work windows.

Site to be Dredged	Quantity to be Dredged (cy)
Federal Navigation Channel at Confluence of Snake and Clearwater Rivers	250,500
Port of Clarkston	9,600
Port of Lewiston	5,100
Hells Canyon Resort Marina	3,600
Greenbelt Boat Basin	2,800
Swallows Swim Beach/Boat Basin	16,000
Lower Granite Dam Navigation Lock-Approach	4,000
Lower Monumental Dam Navigation Lock Approach	20,000
Illia Boat Launch	1,400
Willow Landing Boat Launch	6,200
Hollebeke HMU Irrigation Intake	3,300
Total	322,500

Table 1: Sites proposed for dredging during 2002-2003 and the estimated quantities of dredged materials at each site.

1.3.1.2 Dredged Materials Disposal

Potential disposal sites are listed in Table 2. While the COE may choose to dispose material at any of the listed sites, it is anticipated that most material dredged during the 2002 -2003 work window would be disposed at the Chief Timothy HMU site rather than the Knoxway Canyon site as originally proposed. At Chief Timothy, the COE proposes to contour dredged material to create a "riparian bench" within the SR and cover existing silty substrates riverward of the bench with a one to eight foot deep mantle of sand. Cobbles, dredged from navigation lock approaches, would be arrayed in a band (one foot thick and 30 feet wide) around the bench to prevent erosion The surface of the bench would be under two feet of water at maximum pool elevation (738 feet mean sea level.). Approximately 18 acres of the bench would encroach below minimum operating pool elevation (733 feet mean sea level). Accordingly, the proposed disposal would reduce shallow water habitat within the Lower Granite Pool by roughly 18 acres. Sand would also be deposited over approximately 16 acres of silty, shallow (less than 10 feet deep) to mid (10-20 feet deep) depth habitat in an effort to improve SRF chinook rearing habitat quality.

Dredged material would be barged to disposal areas. At in-water disposal sites, final placement would be accomplished either by bottom dumping from hopper barges, dozing from flat deck barges, hydraulic conveying, draglining, or combinations thereof. Regardless of the placement method(s) selected, containment berms - composed of sands, gravels and cobbles - or silt fences would be installed around the disposal area to minimize turbidity to within water quality standards.

Previous testing suggests that sediments within the action area are contaminated with a wide array of pollutants (see Section 1.3.1.3.2). In that concentrations of these pollutants are much higher in silts than in deposits of larger particles, the COE intends to limit the amount of silt placed in-water. In no case, will an in water disposal area receive more than 30 percent silt. More typically, as is proposed at the Chief Timothy HMU site, shallow water habitats will be enhanced by adding sand and the silts will be reserved for capping the riparian bench.

Dredged material containing contaminant concentrations greater than those identified in the Lower CR Dredged Material Evaluation Framework, and silts surplus to the 30 percent maximum in-water disposal criterion above will be disposed upland. The upland sites include the Joso HMU or a licensed disposal facility. The Joso site would feature containment mechanisms (e.g., an impervious liner) to prevent leaching of unsuitable or contaminated materials back into the SR or other sensitive habitat. As barges cannot presently access this site, it is unlikely that it will be available for material disposal during 2002-2003. Heavily contaminated materials, or those that exceed regulatory thresholds for disposal at Joso, will be disposed at licensed disposal facilities.

At both upland and in-water sites, the COE would attempt to beneficially use dredged materials. Dredge spoils may be used to create or enhance fish and wildlife habitat, as fill at the Port of Wilma or other non-Federal lands, as capping material for the Hanford site, or as road bed material. Some may also be processed to potting soil.

It is anticipated that over the duration of the DMMP the majority of non-contaminated dredged materials would be used for creating or enhancing shallow water habitat for SRF chinook within the action area. Most of the material dredged during the 2002 - 2003 effort would be earmarked for the Chief Timothy HMU site for the combined purposes of enhancing SRF chinook habitat and creating features capable of supporting woody riparian vegetation. Juvenile SRF chinook are often associated with shallow, sandy nearshore areas (Bennet *et al.* 1997). This habitat is thought to be the preferred rearing habitat type within the impounded SR. The COE will use sand obtained through dredging to fill portions of the river and, therefore, mimic the shallow sandy habitat used by rearing SRF chinook. The COE has identified several sites where rearing habitat would be created (Table 2). The sites were identified because they are on the inside of a river bend, have suitable water velocities and underwater contours to facilitate habitat creation, and they enable the placement of dredged material without burying known cultural resource sites.

Site Number	Location (River Mile)	Description of Location	Site Acreage	Site Capacity (Millions of Cubic Yards)
1	113.6-133.4	Chief Timothy Habitat Management Unit	34	0.55
2	119.5-120.5	Kelly Bar/Centennial Island-Left Bank	Completed in 1998	
2	117.5-119.0	Blyton Landing/Yakawawa Canyon-Right Bank	87	5.3
4	115.7-117.0	Knoxway Canyon-Left Bank	44	3.0
5	114.0-115.0	Upriver Granite Point-Right Bank	12	1.4
6	112.5-113.5	Downriver Granite Point-Left Bank	3	1.2
7	110.0-112.0	Wawawai Canyon-Right Bank	51	2.1
8	108.0-109.8	Offield Landing-Left Bank	49	2.6
Total			280	16.1

Table 2. Proposed In-water Disposal Sites within Lower Granite Reservoir for Creation of Shallow Water Rearing Habitat for Juvenile Snake River Fall Chinook Salmon.

1.3.1.3 Monitoring

To minimize negative effects associated with the proposed 2002-2003 DMMP operations, the COE would implement a number of monitoring programs to which dredging operations would be responsive. Monitoring programs would include water quality, sediment contamination, and SRF chinook redd distributions. The data collected from monitoring activities would also be used to guide future dredging operations, minimizing their impact on listed species.

1.3.1.3.1 Water Quality Monitoring

Water quality monitoring for turbidity and ammonia would occur during dredging and disposal operations. Temperature and pH would also be measured concurrent with this monitoring.

Monitoring at dredging sites. The COE would require the dredging contractor to take water samples and measure turbidity using a nephalometer twice per day during active dredging. The contractor would take samples one hour after dredging began and one hour before dredging ended each day. Samples would be taken approximately 300 feet upstream from the dredging operation and roughly 300 feet directly downstream from the point of dredging. The contractor would take two measurements at each location - at roughly 3 feet below the water surface and roughly 3 feet above the river bottom. The contractor would be required to notify the COE within eight hours in the event that the turbidity levels of the dredging operation exceeded allowable levels. These levels are defined as five nephalometric turbidity units (NTUs) over background when the background is 50 NTUs or less, or more than a ten percent increase in turbidity when the background is more than 50 NTUs. Background levels would be measured 300 feet upstream of the dredging operation. Immediately upon determining any exceedence of this NTU limit, the contractor would alter the dredging operation in an attempt to decrease turbidity levels. Monitoring would continue at the downstream location to determine if the NTU levels either returned to an acceptable level or remained high. If the NTU levels do not return to an acceptable level within a time period defined by the Washington Department of Ecology (WDOE), the contractor would stop dredging and wait for the NTU levels to drop below exceedence levels before resuming dredging. If the contractor is unable to meet turbidity requirements, the COE would be contacted for additional instructions.

Ammonia levels would be monitored using techniques similar to those for turbidity monitoring. However, ammonia monitoring would vary in intensity depending on substrate composition. In areas that are expected to be predominately sand, gravel, or cobble (greater than 75 percent by weight), water quality monitors outfitted with ammonia probes and turbidity monitors (as well as other water quality measuring probes) would be positioned about 300 feet upstream and downstream of the dredging operations. In addition, an array of buoys, fitted with monitors would be deployed roughly 650 feet and possibly 1,600 feet downstream. The dredging and disposal activity would be monitored to determine if ammonia levels were exceeded, similar to the turbidity monitoring. If the concentrations of ammonia were found to be high, modification of the dredging operations would occur in a manner similar to those outlined for turbidity. Additional monitors may need to be installed downstream, however, to determine the persistence of ammonia in the water column and mixing zones. If altering of the dredging or disposal activity were determined to have no effect on lowering the concentration of ammonia, the contractor would cease operations and consult with the COE regarding how to proceed.

In areas with high concentrations of silt, including backwater areas and boat basins, ammonia monitoring would be more intense. Ammonia has a higher potential to bind with silts than with larger substrate particles. Accordingly, operations that mobilize silts pose a greater risk of ammonia exposure to fish than those involving larger particles. For this reason, the COE is proposing an adaptive management approach to monitoring ammonia levels at dredging sites in silty areas, and at in-water dredge material disposal areas.

Ammonia monitoring would also occur at all mechanically dredged backwater areas (e.g., boat basins). Such monitoring would minimally include sampling in four key zones of each individual site. Depending on the site size, one or more monitors would be strategically positioned inside the area to be dredged. The second zone would contain at least one monitor in the opening of the backwater area to determine if ammonia were entering the main river. The third zone would be in the main river downstream of the backwater entrance to determine potential concentrations and dispersal as mixing of water from the mainstem and backwater occurs. The fourth zone would be upstream from the boat basin, and used as a control. If concentrations of ammonia were found to be high, dredging operations would be modified. Such modifications may include slowing dredging operations to reduce total turbidity and ammonia suspension. If modifications were ineffective it would be necessary to isolate the dredging within a physical barrier.

Monitoring for ammonia during hydraulic dredging would be similar to that mentioned for mechanical dredging, but monitoring would not be performed during upland disposal.

Monitoring at disposal sites. Ammonia monitoring will occur in at least three zones at each disposal site in a manner similar to the turbidity monitoring. The first would be approximately 300 feet upstream from the planned disposal site, and the second and third would be within the expected turbidity plume to measure the ammonia concentrations at distances of roughly 300 and 1,000 feet from the release site. If the concentrations of ammonia exceed allowable limits, the contractor would be required to modify the disposal activity. If altering the dredging or disposal activity were determined to be ineffective, the contractor would cease operations and consult with the COE regarding how to proceed.

1.3.1.3.2 Sediment Contaminant Monitoring

The COE has sampled all of the proposed 2002-2003 dredge sites for sediment type and contaminant level. Chemical sampling was conducted on sediments for polynuclear aromatic hydrocarbons (PAHs), organophosphates, chlorinated herbicides, oil, grease, glyphosate, ampa, dioxin, and heavy metals. None of the contaminants were found in concentrations high enough to require their handling as hazardous waste (COE and EPA 2001). The COE would ensure that any dredging sites added to the list proposed for dredging in 2002-2003 and presented in Appendix N of the Draft DMMP/Environment Impact Statement would be sampled for sediment typing and containment analysis prior to the 2002-2003 dredging schedule.

In addition to the chemicals described above, the COE would also monitor ammonia levels in sediments targeted for dredging. Ammonia is a contaminant of concern because of its toxicity to fish and because it occurs in relatively high concentrations in lower SR silt. According to the COE (2001), sediments that are mobilized during dredging may contain ammonia concentrations that are high enough to negatively affect freshwater fishes. Specifically, the COE evaluated elutriation data, average concentrations of sediment ammonia, and pH within each of the lower SR reservoirs and then performed a risk analysis using these data and the chronic and acute ammonia criterion for fish from the National Criterion for Ammonia in Fresh Water (EPA 1999). The COE determined that potential impacts varied for each reservoir. In the Lower Granite Reservoir, the potential risk from ammonia exposure was judged to be extremely high because the elutriate ammonia average (3.6 mg/L at 8.5 pH) could exceed the early life stage criterion three-fold and could exceed both acute criterions (2.14 mg/L with salmon present, and 3.20 mg/L with salmon absent). Potential impacts from ammonia in the Little Goose, Lower Monumental, and Ice Harbor reservoirs were judged to be moderate because the elutriate ammonia average could exceed the chronic early life stage criterion.

1.3.1.3.3 Redd Distribution Monitoring

Dredging in the lock approaches of the lower SR dams has the potential to disturb listed SRF chinook redds. Therefore, the COE will survey these areas prior to dredging, using the protocol established by Dauble *et al.* (1995). If a redd is located within the footprint of proposed dredging activities, the COE will either modify the dredging footprint to avoid the redd or postpone dredging to a later date (e.g., after emergence of incubating embryos). Although the COE does not expect redds to be abundant in the lock approaches because of low water velocities, the redd surveys would provide definitive presence/absence data useful for assuring that listed SRF chinook redds would not be adversely affected by dredging.

1.3.2 Twenty-Year Conceptual Plan

The need for dredging operations will continue over the next 20 years. On average, many of the locations described in this consultation require dredging on a two year cycle, however, dredging frequencies are dependent on variable sedimentation rates and may be required more or less often. Dredging may be required in the navigation channel, HMUs, swimming beaches, boat basins, and irrigation intakes. The COE and NOAA Fisheries would consult on these future dredging operations on an annual basis (or as often as necessary). The 20 year conceptual plan, therefore, is a notification that the COE intends to dredge specific areas in the future but the COE will not commence the future dredging until consulting with NOAA Fisheries on specific dredging project elements.

The 20-year Conceptual Plan also includes anticipated work elements that are the subject of this consultation. Among these are: raising the levee system in the Lewiston/Clarkston area, continuing studies of rearing habitat created by dredged material disposal, studying the use of backwater dredging areas as salmonid rearing habitat, studying sediment deposition in the action area, and emergency dredging.

1.3.2.1 Levee Raise

To increase the flood protection level for the cities of Lewiston, Idaho, and Clarkston, Washington the COE proposes to raise portions of the local levees by as much as three feet. The subject levees are sufficient to protect for up to a modeled 100 year flood. Post treatment, they would protect roughly up to a modeled 400 year flood. The top of the existing levee would be excavated to the impervious core and filter to allow the new impervious gravel backfill to tie to the existing core and filter. A twelve foot wide top width would be provided for access and maintenance and to rebuild displaced recreational paths. The levee raise would also involve raising Highway 129 and the SR Road upstream of Asotin.

1.3.2.2 Rearing Habitat Studies

The COE has funded a number of studies to determine the efficacy of in-water dredged material disposal as a method of creating or enhancing SRF chinook rearing habitat. The COE would continue evaluating the efficacy of these efforts over the life of the DMMP. This analysis would focus on abundance and distribution relationships between juvenile SRF chinook and proposed disposal sites, particularly in disposal areas where listed SRF chinook are currently not rearing or are otherwise not abundant (i.e., low velocity areas immediately above Lower Granite dam). Recognizing that there are inherent differences in the physical and biological characteristics of each disposal site, the goal of the studies would be to determine whether in-water disposal is effective for creating rearing habitat. The COE intends to create habitats across a range of shallow and mid water depths. If disposal techniques do not appear to improve rearing conditions for SRF chinook, the COE would modify their disposal methods. If subsequent modifications are also ineffective, they may have to dispose all future dredged materials upland.

1.3.2.3 Backwater Rearing Areas Studies

The COE has determined that a number of backwater sites (Joso barge slip, boat basins, swim beaches, etc.) would be dredged over the next 20 years. Research by Zimmerman and Rasmussen (1981) and Easterbrooks (e.g., 1995) has demonstrated that juvenile chinook salmon rear in off-channel areas where the water depth is shallow and the current velocity is very slow (Casey Ponds). This type of habitat, referred to here as backwater, may be important for rearing in regions of the lower SR reservoirs and McNary Pool. The COE would study backwater areas targeted for dredging to determine the spatial and temporal extent of salmonid use. They would also attempt to identify those habitat attributes to which salmonids may be tuned. The study results would be used to guide future dredging operations.

1.3.2.4 Emergency Dredging

The COE anticipates that emergency dredging may be needed over the span of the DMMP. The scope of such dredging cannot be fully anticipated, and, therefore, emergency operations are beyond the scope of this consultation. If emergency dredging is necessary, the COE would notify NOAA Fisheries as soon as possible to begin the consultation process (consultation may occur after completion of the emergency project). However, in situations involving acts of God, disasters, casualties, potential loss of human life, national defense or security emergencies, the COE should not delay response actions to coordinate with NOAA Fisheries.

2.0 ENDANGERED SPECIES ACT

2.1 Biological Opinion

The Objective of this Biological Opinion (BO) is to determine whether the proposed project is likely to jeopardize the continued existence of UCR chinook, UCR steelhead, SRF chinoook, SRSS chinook, SR sockeye, SR steelhead, MCR steelhead, or result in the destruction or adverse modification of designated Critical Habitat for SRF chinook, SRSS chinook, or SR sockeye.

2.1.1 Status of Species and Critical Habitat

The listing status, biological information, and Critical Habitat elements or potential Critical Habitat for the indicated species are described in Table 3.

Species	**Listing Status Reference**	**Critical Habitat Reference**	**Biological Information**
Snake River (SR) sockeye *(O. nerka)*	Endangered Species, (56 Fed. Reg. 58619, November 20, 1991)	Designated Critical Habitat, (58 Fed. Reg. 68543, December 28, 1993)	Status Review for Snake River Sockeye Salmon (Waples and Johnson 1991)

Snake River fall-run (SRF) chinook (*O. tshawytscha*)	Threatened Species, (57 Fed. Reg. 14653, April 22, 1992). See correction: (57 Fed. Reg. 23458, June 3, 1992)	Designated Critical Habitat, (58 Fed. Reg. 68543, December 28, 1993)	Status Review for Snake River Fall Chinook Salmon (Waples *et al.* 1991)
Snake River spring/summer-run (SRSS) chinook (*O. tshawytscha*)	Threatened Species, (57 Fed. Reg. 14653, April 22, 1992). See correction:(57 Fed. Reg. 23458, June 3 1992)	Designated Critical Habitat,(58 Fed. Reg. 68543, December 28, 1993). See update: (64 Fed. Reg. 57399, October 25, 1999)	Status Review for Snake River Spring and Summer Run Chinook Salmon (Matthews and Waples 1991)
Snake River Basin (SRB) steelhead (*O. mykiss*)	Threatened Species, August 18, 1997 (62 Fed. Reg. 43937)	No Designated Critical Habitat	Status Review of West Coast Steelhead from Washington, Idaho, Oregon and California, (Busby *et al.*, 1996)
Upper Columbia River (UCR) steelhead (*O. mykiss*)	Endangered Species, August 18, 1997 (62 Fed. Reg. 43937)	No Designated Critical Habitat	Status Review of West Coast Steelhead from Washington, Idaho, Oregon and California, (Busby *et al.*, 1996)
Upper Columbia River spring-run (UCRS) chinook (*O. tshawytscha*)	Endangered Species, March 24, 1999 (64 Fed. Reg. 14308)	No Designated Critical Habitat	Status Review of Chinook Salmon from Washington, Idaho, Oregon and California, (Myers *et al.*, 1998)
Middle Columbia River (MCR) steelhead (*O. mykiss*)	Threatened Species, March 25, 1999 (64 Fed. Reg. 14517)	No Designated Critical Habitat	Status Review of West Coast Steelhead from Washington, Idaho, Oregon and California, (Busby *et al.*, 1996)

Table 3. References to Federal Register Notices and Status Reviews Containing Additional Information Concerning Listing status, Biological Information, and Critical Habitat Designations for Listed Species Considered in this BO.

The proposed actions would occur within the designated Critical Habitat of endangered SR sockeye, threatened SRF chinook, and threatened SRSS chinook. Essential features of this Critical Habitat include substrate, water quality/quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions (58 Fed. Reg. 68543, December 28, 1993).

The information presented below summarizes the status of species and ESUs that are the subject of this consultation. Much of the information, particularly concerning SR species, has been taken directly from the FCRPS BO (NMFS 2000)

2.1.1.1 Snake River Sockeye

The SR sockeye salmon ESU, listed as endangered on November 20, 1991 (56 Fed. Reg. 58619), includes populations of sockeye salmon from the SRB, Idaho (extant populations occur only in the Salmon River subbasin). Under NOAA Fisheries' interim policy on artificial propagation (58 Fed. Reg. 17573), the progeny of fish from a listed population that are propagated artificially are considered part of the listed species and are protected under ESA. Thus, although not specifically designated in the 1991 listing, SR sockeye salmon produced in the captive broodstock program are included in the listed ESU. Given the dire status of the wild population under any criteria (16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000), NOAA Fisheries considers the captive broodstock and its progeny essential for recovery. Critical habitat was designated for SR sockeye salmon on December 28, 1993 (58 Fed. Reg. 68543).

The only remaining sockeye in the SR system are found in Redfish Lake, on the Salmon River. The nonanadromous form (kokanee), found in Redfish Lake and elsewhere in the SRB, is included in the ESU. SR sockeye occur within the action area only during their smolt and adult migrations.

2.1.1.2 Snake River Fall Chinook

The SRF chinook salmon ESU, listed as threatened on April 22, 1992 (57 Fed. Reg. 14653), includes all natural-origin populations of fall chinook in the mainstem SR and several tributaries including the Tucannon, Grande Ronde, Salmon, and Clearwater rivers. Fall chinook from the Lyons Ferry Hatchery are included in the ESU but are not listed. Critical habitat was designated for SRF chinook salmon on December 28, 1993 (58 Fed. Reg. 68543).

This ESU includes the mainstem river and all tributaries, from their confluence with the Columbia River to the Hells Canyon complex. Because genetic analyses indicate that fall-run chinook salmon in the SR are distinct from the spring/summer-run in the Snake basin (Waples *et al.* 1991), SRF chinook salmon are considered separately from the other two forms. They are also considered separately from the UCR summer- and fall-run ESU because of considerable differences in habitat characteristics and adult ocean distribution and less definitive, but still significant, genetic differences.

While most SRF Chinook spawn above the area targeted for dredging, some have been documented spawning within it, particularly near lock approaches. SRF fall chinook are heavily reliant on the action area for rearing and pass through it on their way to the ocean. Some SRF chinook appear to exhibit a stream type life history (La Riviere, pers. comm.) and may be in the action area during dredging operations.

2.1.1.3 Snake River Spring/Summer Run Chinook

The SRSS ESU, listed as threatened on April 22, 1992 (57 Fed. Reg. 14653), includes all natural-origin populations in the Tucannon, Grande Ronde, Imnaha, and Salmon rivers. Some or all of the fish returning to several of the hatchery programs are also listed including those returning to the Tucannon River, Imnaha, and Grande Ronde hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for SRSS chinook salmon on December 28, 1993 (58 Fed. Reg. 68543), and was revised on October 25, 1999 (64 Fed. Reg. 57399).

SRSS chinook are not thought to rear in the impounded portions of the SR. They do pass through the action area on their adult and smolt migrations.

2.1.1.4 Snake River Steelhead

The SR steelhead ESU, listed as threatened on August 18, 1997 (62 Fed. Reg. 43937), includes all natural-origin populations of steelhead in the SRB of southeast Washington, northeast Oregon, and Idaho. None of the hatchery stocks in the SRB is listed, but several are included in the ESU. Critical habitat is not presently designated for SR steelhead.

Steelhead spawning habitat in the SR is distinctive in having large areas of open, low-relief streams at high elevations. In many SR tributaries, spawning occurs at a higher elevation (up to 2,000 m) than for steelhead in any other geographic region. SRB steelhead also migrate farther from the ocean (up to 1,500 km) than most.

SR steelhead are not known to spawn or rear in the impounded reaches of the SR. Adult SR steelhead do hold in the mainstem Snake and Columbia Rivers for extended periods (months) prior to spawning. Adult SR steelhead are likely to be in the action area during the proposed work window.

2.1.1.5 UCRS Chinook

UCRS salmon ESU, listed as endangered on March 24, 1999 (64 Fed. Reg. 14308), includes all natural-origin, stream-type chinook salmon from river reaches above Rock Island Dam and downstream of Chief Joseph Dam, including the Wenatchee, Entiat, and Methow River basins. All chinook in the Okanogan River are apparently ocean-type and are considered part of the UCR summer- and fall-run ESU. The spring-run components of the following hatchery stocks are also listed: Chiwawa, Methow, Twisp, Chewuch, and White rivers and Nason Creek. Critical habitat is not presently designated for UCRS chinook.

UCRS chinook spawn and rear well upstream of the McNary pool, and are very unlikely to be near the action area during dredging and disposal operations. They are not believed to rely on any portion of the action area for their rearing requirements.

2.1.1.6 UCR Steelhead

The UCR steelhead ESU, listed as endangered on August 18, 1997 (62 Fed. Reg. 43937), includes all natural-origin populations of steelhead in the Columbia River basin upstream from the Yakima River, Washington, to the U.S./Canada border. The Wells Hatchery stock is included among the listed populations. Critical habitat is not presently designated for UCR steelhead.

UCR steelhead spawn and rear well upstream of the McNary pool, and are very unlikely to be near the action area during dredging and disposal operations. They are not believed to rely on any portion of the action area for their rearing requirements.

2.1.1.7 Mid-Columbia River Steelhead

MCR steelhead ESU, listed as threatened on March 25, 1999 (64 Fed. Reg. 14517), includes all natural-origin populations in the CR basin above the Wind River, Washington, and the Hood River, Oregon, including the Yakima River, Washington. This ESU includes the only populations of winter inland steelhead in the United States (in the Klickitat River, Washington, and Fifteenmile Creek, Oregon). Both the Deschutes River and Umatilla River hatchery stocks are included in the ESU, but are not listed. Critical habitat is not presently designated for MCR steelhead.

Hatchery management practices are suspected to be a major factor in the decline of this ESU. The genetic contribution of non-indigenous, hatchery stocks may have reduced the fitness of the locally adapted, native fish. A decrease in fitness could have occurred through hybridization and associated reductions in genetic variation or introduction of deleterious (non-adapted) genes. Hatchery fish can also directly displace natural spawning populations, compete for food resources, or engage in agonistic interactions (Campton and Johnston 1985; Waples 1991; Hilborn 1992; NMFS 1996; 63 Fed. Reg. 11798, March 10, 1998).

The Yakima and Walla Walla River populations of MCR steelhead are potentially affected by the proposed action. However, both populations spawn and rear well upstream of the McNary pool, and are very unlikely to be near the action area during dredging and disposal operations. They are not believed to rely on any portion of the action area for their rearing requirements.

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consulting regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to adversely modify Critical Habitat. This analysis involves the initial steps of (1) defining the biological requirements and current status of the listed species, and (2) evaluating the relevance of the environmental baseline to the species' current status.

NOAA Fisheries then evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making the determination, NOAA Fisheries must consider the estimated level of mortality attributable to (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmon's life history stages that may occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

Furthermore, NOAA Fisheries evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' designated Critical Habitat. The NOAA Fisheries must determine whether habitat modifications appreciably diminish the value of Critical Habitat for both the survival and recovery of the listed species. The NOAA Fisheries identifies those effects of the action that impair the function of any essential element of Critical Habitat. The NOAA Fisheries then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NOAA Fisheries concludes that the action will adversely modify Critical Habitat, it must identify any reasonable and prudent alternatives available.

Guidance for making determinations of jeopardy and adverse modification of Critical Habitat are contained in NOAA Fisheries' document: *The Habitat Approach, Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids*, August 1999 (available online at: www.nwr.noaa.gov/1habcon/habweb/pubs/newjeop9.pdf).

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. The NOAA Fisheries' Critical Habitat analysis considers the extent to which the proposed action impairs the function of essential elements necessary for migration and spawning of the listed salmon under the existing environmental baseline.

2.1.2.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA Section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. The NOAA Fisheries also considers the current status of the listed species; taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its original decision to list the species for protection under the ESA. Additionally, the assessment will consider any new information or data that are relevant to the determination.

The relevant biological requirements are those necessary for the listed species to survive and recover to naturally reproducing population levels at which time, protection under the ESA would be unnecessary. Species or ESUs not requiring ESA protection have the following attributes: population sizes large enough to maintain genetic diversity and heterogeneity, the ability to adapt to and survive environmental variation, and are self-sustaining in the natural environment

SR sockeye, SRF chinook, SRSS chinook, SR steelhead, UCRS chinook, UCR steelhead, and MCR steelhead have similar basic biological requirements. These requirements include food, flowing water (quantity), high quality water (cool, free of pollutants, high dissolved oxygen concentrations, low sediment content), clean spawning substrate, and unimpeded migratory access to and from spawning and rearing areas (adapted from Spence *et al.* 1996).

NOAA Fisheries has related the biological requirements for listed salmonids to a number of habitat attributes, or pathways, in the Matrix of Pathways and Indicators (MPI); available online at: www.nwr.noaa.gov/1habcon/habweb/pubs/matrix.pdf). These pathways (water quality, habitat access, habitat elements, channel condition and dynamics, flow/hydrology, watershed conditions, disturbance history, and riparian reserves) indirectly measure the baseline biological health of listed salmon populations through the health of their habitat. Specifically, each pathway is made up of a series of individual indicators (e.g., indicators for water quality include temperature, sediment, and chemical contamination.) that are measured or described directly (see: NMFS 1996). Based on the measurement or description, each indicator is classified within a category of the properly functioning condition (PFC) framework: (1) properly functioning, (2) at risk, or (3) not properly functioning. Properly functioning condition is defined as "the sustained presence of natural habitat forming processes in a watershed that are necessary for the long-term survival of the species through the full range of environmental variation."

The specific biological requirements to be affected by the proposed include food, water quality, and, potentially, migratory access. Further, the proposed action is likely to affect habitat attributes including water quality, habitat access, habitat elements and channel condition.

2.1.2.2 Factors Affecting the Species at the Population Level

The information in the following section was extracted directly from the BO for the Federal Columbia River Power System (NMFS 2000).

2.1.2.2.1 Snake River Sockeye

Life History. In general, juvenile sockeye salmon rear in the lake environment for 1, 2, or 3 years before migrating to sea. Adults typically return to the natal lake system to spawn after spending 1, 2, 3, or 4 years in the ocean (Gustafson *et al.* 1997).

Habitat and Hydrology. In 1910, impassable Sunbeam Dam was constructed 20 miles downstream of Redfish Lake. Although several fish ladders and a diversion tunnel were installed during subsequent decades, it is unclear whether enough fish passed above the dam to sustain the run. The dam was partly removed in 1934, after which Redfish Lake runs partially rebounded. Evidence is mixed as to whether the restored runs constitute anadromous forms that managed to persist during the dam years, nonanadromous forms that became migratory, or fish that strayed in from outside the ESU.

Population Trends and Risks. NOAA Fisheries proposed an interim recovery level of 2,000 adult SR sockeye salmon in Redfish Lake and two other lakes in the SRB (Table 1.3-1 in NMFS

1995c). Low numbers of adult SR sockeye salmon preclude a CRI- or QAR-type quantitative analysis of the status of this ESU. However, because only 16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000, NOAA Fisheries considers the status of this ESU to be dire under any criteria. Clearly the risk of extinction is very high.

2.1.2.2.2 Snake River Fall Chinook

Life History. Fall chinook salmon in this ESU are ocean-type. Adults return to the SR at ages 2 through 5, with age 4 most common at spawning (Chapman *et al*. 1991). Spawning, which takes place in late fall, occurs in the mainstem and in the lower parts of major tributaries (NWPPC 1989; Bugert *et al*. 1990). Juvenile fall chinook salmon move seaward slowly as subyearlings, typically within several weeks of emergence (Chapman *et al*. 1991). Based on modeling by the Chinook Technical Committee, the Pacific Salmon Commission estimates that a significant proportion of the SRF chinook (about 36 percent) are taken in Alaska and Canada, indicating a far ranging ocean distribution. In recent years, only 19 percent were caught off Washington, Oregon, and California, with the balance (45 percent) taken in the Columbia River (Simmons 2000).

Some SRF chinook historically migrated over 1,500 km from the ocean. Although the Snake River population is now restricted to habitat in the lower river, genes associated with the lengthier migration may still reside in the population. Because longer freshwater migrations in chinook salmon tend to be associated with more-extensive oceanic migrations (Healey 1983), maintaining populations occupying habitat that is well inland may be important in continuing diversity in the marine ecosystem as well.

Habitat and Hydrology. With hydrosystem development, the most productive areas of the SRB are now inaccessible or inundated. The upper reaches of the mainstem SR were the primary areas used by fall chinook salmon, with only limited spawning activity reported downstream from river kilometer (Rkm) 439. The construction of Brownlee Dam (1958; Rkm 459), Oxbow Dam (1961; Rkm 439), and Hells Canyon Dam (1967; Rkm 397) eliminated the primary production areas of SRF chinook salmon. There are now 12 dams on the mainstem SR, and they have substantially reduced the distribution and abundance of fall chinook salmon (Irving and Bjornn 1981).

Hatchery Influence. The SR has contained hatchery-reared fall chinook salmon since 1981 (Busack 1991). The hatchery contribution to SR escapement has been estimated at greater than 47 percent (Myers *et al*. 1998). Artificial propagation is recent, so cumulative genetic changes associated with it may be limited. Wild fish are incorporated into the brood stock each year, which should reduce divergence from the wild population. Release of subyearling fish may also help minimize the differences in mortality patterns between hatchery and wild populations that can lead to genetic change (Waples 1999). (See NMFS [1999] for further discussion of the SRF chinook salmon supplementation program.)

Population Trends and Risks. For the SRF chinook salmon ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.94 to 0.86, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (McClure *et al*. 2000). NOAA Fisheries has also estimated the risk of absolute extinction for the aggregate SRF chinook salmon population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.40 (McClure *et al*. 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years is 1.00 (McClure *et al*. 2000).

2.1.2.2.3 Snake River Spring/Summer Chinook.

Life History. In the SRSS share key life history traits. Both are stream type fish, with juveniles that migrate swiftly to sea as yearling smolts. Depending primarily on location within the basin (and not on run type), adults tend to return after either 2 or 3 years in the ocean. Both spawn and rear in small, high-elevation streams (Chapman *et al*. 1991), although where the two forms coexist, spring-run chinook spawn earlier and at higher elevations than summer-run chinook.

Habitat and Hydrology. Even before mainstem dams were built, habitat was lost or severely damaged in small tributaries by construction and operation of irrigation dams and diversions, inundation of spawning areas by impoundments, and siltation and pollution from sewage, farming, logging, and mining (Fulton1968). Recently, the construction of hydroelectric and water storage dams without adequate provision for adult and juvenile passage in the upper SR has kept fish from all spawning areas upstream of Hells Canyon Dam.

Hatchery Influence. There is a long history of human efforts to enhance production of chinook salmon in the SRB through supplementation and stock transfers. The evidence is mixed as to whether these efforts have altered the genetic makeup of indigenous populations. Straying rates appear to be very low.

Population Trends and Risks. For the SRSS chinook salmon ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to the effectiveness of fish of wild origin (McClure *et al*. 2000). NOAA Fisheries has also estimated median population growth rates and the risk of absolute extinction for the seven spring/summer chinook salmon index stocks, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years for the wild component ranges from zero for Johnson Creek to 0.78 for the Imnaha River (McClure *et al*. 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years ranges from zero for Johnson Creek to 1.00 for the wild component in the Imnaha River (McClure *et al*. 2000).

2.1.2.2.4 Snake River Steelhead

Life History. Fish in this ESU are summer steelhead. They enter freshwater from June to October and spawn during the following March to May. Two groups are identified, based on migration timing, ocean-age, and adult size. A-run steelhead, thought to be predominately age-1-ocean, enter freshwater during June through August. B-run steelhead, thought to be age-2-ocean, enter freshwater during August through October. B-run steelhead typically are 75 to 100 mm longer at the same age. Both groups usually smolt as 2- or 3-year-olds. All steelhead are iteroparous, capable of spawning more than once before death.

Habitat and Hydrology. Hydrosystem projects create substantial habitat blockages in this ESU; the major ones are the Hells Canyon Dam complex (mainstem SR) and Dworshak Dam (North Fork Clearwater River). Minor blockages are common throughout the region. Steelhead spawning areas have been degraded by overgrazing, as well as by historical gold dredging and sedimentation due to poor land management. Habitat in the Snake basin is warmer and drier and often more eroded than elsewhere in the Columbia River basin or in coastal areas.

Hatchery Influence. Hatchery fish are widespread and stray to spawn naturally throughout the region. In the 1990s, an average of 86 percent of adult steelhead passing Lower Granite Dam were of hatchery origin. Hatchery contribution to naturally spawning populations varies, however, across the region. Hatchery fish dominate some stocks, but do not contribute to others.

Population Trends and Risks. For the SR steelhead ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.91 to 0.70, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (McClure *et al*. 2000). NOAA Fisheries has also estimated the risk of absolute extinction for the A- and B-runs, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 for A-run steelhead and 0.93 for B-run fish (McClure *et al*. 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years is 1.00 for both runs (McClure *et al*. 2000).

2.1.2.2.5 UCRS Chinook

Life History. UCRS chinook are considered stream-type fish, with smolts migrating as yearlings. Most stream-type fish mature at 4 years of age. Few coded-wire tags are recovered in ocean fisheries, suggesting that the fish move quickly out of the north central Pacific and do not migrate along the coast.

Habitat and Hydrology. Spawning and rearing habitat in the Columbia River and its tributaries upstream of the Yakima River includes dry areas where conditions are less conducive to steelhead survival than in many other parts of the Columbia basin (Mullan *et al*. 1992). Salmon in this ESU must pass up to nine Federal and private dams, and Chief Joseph Dam prevents access to historical spawning grounds farther upstream. Degradation of remaining spawning and rearing habitat continues to be a major concern associated with urbanization, irrigation projects, and livestock grazing along riparian corridors. Overall harvest rates are low for this ESU, currently less than 10 percent (ODFW and WDFW 1995).

Hatchery Influence. Spring-run chinook salmon from the Carson National Fish Hatchery (a large composite, nonnative stock) were introduced into and have been released from local hatcheries (Leavenworth, Entiat, and Winthrop National Fish Hatcheries [NFH]). Little evidence suggests that these hatchery fish stray into wild areas or hybridize with naturally spawning populations. In addition to these national production hatcheries, two supplementation hatcheries are operated by the Washington Department of Fish and Wildlife (WDFW) in this ESU. The Methow Fish Hatchery Complex (operations began in 1992) and the Rock Island Fish Hatchery Complex (operations began in 1989) were both designed to implement supplementation programs for naturally spawning populations on the Methow and Wenatchee rivers, respectively (Chapman *et al*. 1995).

Population Trends and Risks. For the UCRS chinook salmon ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.85 to 0.83, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (McClure *et al*. 2000). NOAA Fisheries has also estimated median population growth rates and the risk of absolute extinction for the three spawning populations identified by Ford *et al*. (1999), using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from 0.97 for the Methow River to 1.00 for the Wenatchee and Entiat rivers (Table B-5 in McClure *et al*. 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of extinction within 100 years is 1.00 for all three spawning populations (McClure et al. 2000).

NOAA Fisheries has also used population risk assessments for UCR spring chinook salmon and steelhead ESUs from the draft quantitative analysis report (QAR) (QAR; Cooney 2000). Risk assessments described in that report were based on Monte Carlo simulations with simple spawner/spawner models that incorporate estimated smolt carrying capacity. Population dynamics were simulated for three separate spawning populations in the UCR spring chinook salmon ESU, the Wenatchee, Entiat, and Methow populations. The QAR assessments showed extinction risks for UCR spring chinook salmon of 50 percent for the Methow, 98 percent for the Wenatchee, and 99 percent for the Entiat spawning populations. These estimates are based on the assumption that the median return rate for the 1980 brood year to the 1994 brood year series will continue into the future.

2.1.2.2.6 UCR Steelhead

Life History. As is other ESUs (the Snake and mid-Columbia River basins), steelhead in the Upper Columbia River ESU remain in freshwater up to a year before spawning. Smolt age is dominated by two-year-olds. Based on limited data, steelhead from the Wenatchee and Entiat Rivers return to freshwater after one year in salt water, whereas Methow River steelhead are primarily age-two-ocean (Howell *et al*. 1985). Life history characteristics for UCR steelhead are similar to those of other inland steelhead ESUs; however, some of the oldest smolt ages for steelhead, up to seven years, are reported from this ESU. The relationship between anadromous and nonanadromous forms in the geographic area is unclear.

Habitat and Hydrology. The Chief Joseph and Grand Coulee dam construction caused blockages of substantial habitat, as did that of smaller dams on tributary rivers. Habitat issues for this ESU relate mostly to irrigation diversions and hydroelectric dams, as well as to degraded riparian and instream habitat from urbanization and livestock grazing.

Hatchery Influence. Hatchery fish are widespread and escape to spawn naturally throughout the region. Spawning escapement is dominated by hatchery-produced fish.

Population Trends and Risks. For the UCR steelhead ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (McClure *et al*. 2000). NOAA Fisheries has also estimated the risk of absolute extinction for the aggregate UCR steelhead population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.25 (McClure *et al*. 2000). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years is 1.00 (McClure *et al*. 2000).

Because of data limitations, the QAR steelhead assessments in Cooney (2000) were limited to two aggregate spawning groups—the Wenatchee/Entiat composite and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for UCR steelhead is 100 percent. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35 percent for the Wenatchee/Entiat and 28 percent for the Methow populations. At a hatchery effectiveness of 0.75, risks of 100 percent were projected for both populations.

2.1.2.2.7 MCR Steelhead

Life History. Most fish in this ESU smolt at 2 years and spend 1 to 2 years in salt water before reentering freshwater, where they may remain up to a year before spawning (Howell *et al*. 1985, BPA 1992). All steelhead upstream of The Dalles Dam are summer-run (Schreck *et al*. 1986, Reisenbichler *et al*. 1992, Chapman *et al*. 1994). The Klickitat River, however, produces both summer and winter steelhead, and age-2-ocean steelhead dominate the summer steelhead, whereas most other rivers in the region produce about equal numbers of both age-1- and 2-ocean fish. A nonanadromous form co-occurs with the anadromous form in this ESU; information suggests that the two forms may not be isolated reproductively, except where barriers are involved.

Habitat and Hydrology. Substantial habitat blockages are present in this ESU. While Pelton Dam on the Deschutes River is one of the more significant, minor blockages occur throughout the region. In the Yakima Basin, Cle Elum, Rimrock, Bumping, Keechelus, and Kachess Dams all Federal water storage dams, have blocked access to many miles of habitat since the early part of the Twentieth century. Water withdrawals and overgrazing have seriously reduced summer flows in the principal summer steelhead spawning and rearing tributaries of the Deschutes River. High summer and low winter temperatures are limiting factors for salmonids in many streams in this region (Bottom *et al*. 1985).

Hatchery Influence. Continued increases in the proportion of stray steelhead in the Deschutes River basin is a major concern. The ODFW and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) estimate that 60 percent to 80 percent of the naturally spawning population consists of strays, which greatly outnumber naturally produced fish. Although the reproductive success of stray fish has not been evaluated, their numbers are so high that major genetic and ecological effects on natural populations are possible (Busby *et al*. 1999).

The negative effects of any interbreeding between stray and native steelhead will be exacerbated if the stray steelhead originated in geographically distant river basins, especially if the river basins are in different ESUs. The populations of steelhead in the Deschutes River basin include the following:

- Steelhead native to the Deschutes River
- Hatchery steelhead from the Round Butte Hatchery on the Deschutes River
- Wild steelhead strays from other rivers in the CRB
- Hatchery steelhead strays from other CRB streams

Regarding the latter, CTWSRO reports preliminary findings from a tagging study by T. Bjornn and M. Jepson (University of Idaho) and NOAA Fisheries suggesting that a large fraction of the steelhead passing through CR Dams (e.g., John Day and Lower Granite dams) have entered the Deschutes River and then returned to the mainstem Columbia River. A key unresolved question about the large number of strays in the Deschutes basin is how many stray fish remain in the basin and spawn naturally.

Population Trends and Risks. For the MCR steelhead ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al*. 2000). NOAA Fisheries has also estimated the risk of absolute extinction for four of the subbasin populations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Umatilla River and Deschutes River summer runs (McClure *et al*. 2000). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Deschutes River summer run (McClure *et al*. 2000).

2.1.2.3 Factors Affecting the Species within the Action Area

Section 4(a)(1) of the ESA and NOAA Fisheries listing regulations (50 C.F.R § 424) set forth procedures for listing species. The Secretary of Commerce must determine, through the regulatory process, if a species is endangered or threatened based upon any one or a combination of the following factors; (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence.

The proposed action includes activities that would have some level of effects with short-term impacts from category (1) and the potential for long-term impacts from categories (4) and (5). The characterization of these effects and a conclusion relating the effects to the continued existence of the subject species of this consultation are provided in Section 2.1.3.

The lower SR and MCR, the action area for the proposed project, have been substantially modified to the detriment of listed salmonids. The most conspicuous habitat modifications are caused by dams on the these rivers. The dams have transformed portions of the rivers from fully lotic (free flowing) to essentially lentic (standing water) environments. The reduction in absolute water velocity and desynchronization of historical run off patterns has dramatically altered the physical characteristics of both rivers. Additionally, sediment transport and deposition dynamics, water temperature, habitat diversity, and habitat access have been altered to the detriment of listed salmonids as a result of dam construction (Spence *et al.* 1996).

Concurrent with physical changes, indirect biological transformation has also occurred. Exotic species that prey on salmonids, including percids and centrarchids, have become established in the Snake and Columbia Rivers (Wydoski and Whitney 1979). These predators may feed directly on salmonids (Tabor *et al.* 1993) or compete for other food or habitat resources. Other native predators including the pikeminnow (*Ptychocheilus oregonensis)* have exploited the impounded environment created by dams, although their predation rates are higher in the lower Columbia River (Faler *et al.* 1988).

A number of general anthropogenic factors have also influenced listed species. Along the shores of the Snake and Columbia Rivers, agriculture, transportation infrastructure, commercial and residential development have displaced riparian and shallow water habitat used by juvenile salmonids. This development also contributes some quantity of runoff and pollution, which may include sediments, fertilizer, pesticides, and petroleum products. In the lower SR, above Lower

Granite Dam, agricultural land use is suspected to be a major cause of sedimentation and ammonia accumulation (COE 2001).

2.1.2.4 Environmental Baseline

The environmental baseline represents the current basal set of conditions to which the effects of the proposed action would be added. The term "environmental baseline" means "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process " (50 C.F.R.§ 402.02).

The major factors influencing the environmental baseline within the action area include: (1) the presence of hydroelectric dams, (2) the actions carried out under the NOAA Fisheries Federal Columbia River Power System (FCRPS) BO, (3) agricultural water use, and (4) land use and shoreline development.

2.1.2.4.1. Hydroelectric Dams

The mainstem dams on the Lower Snake and Columbia Rivers are the most prominent features that influence the environmental baseline within the action area. Additional mainstem dams above and below the action area also influence the environmental baseline within the action area. These dams have substantially changed the Snake and Columbia Rivers' physical and biological characteristics. They have altered temperature profiles, inundated spawning habitat, created passage barriers, diminished sediment transport, altered seasonal flow patterns, imparted broad diel flow fluctuations, eliminated lotic channel characteristics, and created habitat for species that prey on or compete with salmonids.

In terms of MPI indicators, the dams have caused a broad range of habitat degradation. At the Water Quality pathway, the hydropower dams have contributed to high instream temperatures and high concentrations (supersaturation) of dissolved atmospheric gases (Spence *et al.* 1996). Portions of the action area have been identified on the State 303(d) list (Clean Water Act) for degraded temperature and total dissolved gas parameters (WSDOE 1998). As a result, the MPI Temperature indicator is *not properly functioning*.

At the Habitat Elements pathway, all indicators are *not properly functioning*. When the Snake and Columbia Rivers were transformed from flowing bodies of water to a series of slow moving reservoirs (NMFS 2000), much of the historic habitat was inundated and habitat functions lost. Sediment transport has been restricted to the extent that fine materials (silt, sand) settle out of the water column in the reservoirs instead of being flushed downstream (causing sedimentation) (NMFS 1996). Additionally, low water velocity and the physical presence of the dams (both upstream and in the action area) traps spawning substrates, preventing downstream recruitment (NMFS 1996). Off-channel habitat, refugia (remnant habitat that buffers populations against extinction), and large woody debris production have been reduced by inundating off-channel areas and historic riparian zones. Because the flow is highly regulated between dams, hydraulic variation is lacking. Consequently, pools, riffles and other instream habitat are greatly reduced or have been eliminated.

At the Habitat Access pathway, the dams within the action area inhibit safe passage of listed salmonids. The dams create conditions where listed salmonids may be killed or injured by mechanical impingement or high dissolved gas levels (NMFS 1996, Spence *et al.* 1996). Additionally, the dams create false attraction to impassable areas, habitat for predators, and otherwise delay the progress of migrants. The direct presence of the dams, as well as secondary problems they cause puts the MPI Physical Barriers Indicator at *not properly functioning* within the action area.

Within the Channel Condition and Dynamics pathway, the Floodplain Connectivity indicator is *not properly functioning*. Dam operations, flow (reservoir) management, and the related inundation of off-channel rearing and floodplain areas have reduced the size and quality of floodplains along the Snake and Columbia Rivers (NMFS 2000).

In terms of the Flow/Hydrology pathway, dams have affected the Change in Peak/Base Flows indicator to the extent that the indicator is *not properly functioning*. Dam operations, by nature, restrict and control the passage of water through river basins. The hydrosystem on the Snake and Columbia Rivers affects the natural hydrograph by decreasing spring and summer flows and increasing fall and winter flows (NMFS 2000).

2.1.2.4.2. Federal Columbia River Power System BO

On December 21, 2000, NOAA Fisheries issued the FCRPS BO (NMFS 2000), finding that the FCRPS jeopardizes the continued existence and survival of endangered SR sockeye, threatened SRF chinook, threatened SRSS chinook, threatened SR steelhead, endangered UCRS chinook, endangered UCR steelhead, and threatened MCR steelhead ESUs. To avoid jeopardy, Federal agencies regulating the FCRPS were provided a number of Reasonable and Prudent Alternatives (RPAs). In the RPAs, NOAA Fisheries identified four categories of actions where survival and recovery of listed salmonids may be enhanced: hydroelectric, habitat, harvest, and hatcheries. It is important to note that a number of the RPAs involve off-site mitigation (e.g., habitat improvements in estuaries and mainstem tributaries): modifying hydroelectric actions alone is insufficient to avoid jeopardy, habitat improvement is also necessary.

The FCRPS BO illustrates that the environmental baseline is degraded within the action area and throughout the impounded Columbia and Snake Rivers. Maintaining current hydroelectric practices without additional improvements in habitat, harvest and hatchery areas would jeopardize the continued existence of endangered SR sockeye, threatened SRF chinook, threatened SRSS chinook, threatened SR steelhead, endangered UCRS chinook, endangered UCR steelhead, and threatened MCR steelhead ESUs.

2.1.2.4.3 Agricultural Water Use

Water quantity problems are a significant cause of habitat degradation and reduced fish production. The water quantity issues are more acute in individual tributaries, but their indirect effects extend to mainstem Snake and Columbia River habitats. Millions of acres of land in the Snake and Columbia River basins are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion. Withdrawals in the Snake Basin have a substantial affect on summer flows, and therefore, indirectly influence water temperature, water particle travel time, and sediment transport. Tail water from irrigated fields contributes sediment, nutrients and pesticides to the action area (NMFS 2000).

2.1.2.4.4 Land Use and Shoreline Development

The action area is affected by a range of land uses and varying levels of shoreline development. Crop land, marinas, docks, residential dwellings, roads, railroads, rip-rap, and landscaping have displaced natural habitat features. In terms of the MPI, this land use and shoreline development has primarily affected the Habitat Elements and Channel Condition and Dynamics pathways. In general, shoreline development has reduced the quality of nearshore salmonid habitat by eliminating native riparian vegetation, (contributing to the *not properly functioning* status for Large Woody Debris and Refugia indicators); displacing shallow water habitat with fill materials (contributing to the *not properly functioning* status for the Off-Channel Habitat indicator); and by further disconnecting the Snake and Columbia Rivers from historic floodplain areas (contributing to the *not properly functioning* status for the Floodplain Connectivity indicator). Additionally, agricultural land use (e.g., grazing, growing crops, irrigating) has reduced the quality of riparian buffers and the stability of soils adjacent to rivers and streams. Without adequate buffers and effective soil stabilization, sediments are easily eroded and transported to surface waters where they accumulate. Although smaller tributaries may be affected initially, erosion and sedimentation ultimately affect mainstem portions of the Snake and Columbia Rivers. Some areas, such as Lower Granite Reservoir, have chronic problems with sedimentation and require routine dredging (Reckendorf and Pedone 1989; COE 2001).

2.1.3 Effects of the Proposed Action

The NOAA Fisheries' ESA implementing regulations define "effects of the action" as "the direct and indirect effects of an action on the species or Critical Habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline." Direct effects are immediate effects of the project on the species or its habitat, and indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur (50 C.F.R.§ 402.02).

2.1.3.1 Direct Effects

Direct effects result from the agency action and include the effects of interrelated and interdependent actions. Future Federal actions that are not direct effects of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated.

The direct effects of the proposed DMMP would result from activities that would commence during the 2002-2003 project phase. These activities include dredging and in-water dredged material disposal. The primary direct effects of these activities include (1) turbidity, (2) suspension of contaminants, (3) entrainment of juvenile salmonids, (4) loss or alteration of SRF spawning habitat, and (5) filling of shallow water habitat.

2.1.3.1.1 Turbidity

Dredging and the in-water disposal of dredged materials would disturb and suspend a significant volume of benthic sediment. In the immediate vicinity of these activities, turbidity would likely substantially exceed natural background levels, potentially affecting listed fish.

Quantifying turbidity levels, and their effect on fish species, is complicated by several factors. First, turbidity from an instream activity will typically decrease as distance from the activity increases. How quickly turbidity levels attenuate is dependent upon the quantity of materials in suspension (e.g., mass or volume), the particle size of suspended sediments, the amount and velocity of ambient water (dilution factor), and the physical/chemical properties of the sediments. Second, the impact of turbidity on fishes is not only related to the turbidity levels, but also the particle size of the suspended sediments.

For salmonids, turbidity elicits a number of behavioral and physiological responses (i.e., gill flaring, coughing, avoidance, increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982; Sigler *et al.* 1984; Berg and Northcote 1985; Servizi and Martens 1992). The magnitude of these stress responses is generally higher when turbidity is increased and particle size decreased (Bisson and Bilby 1982; Servizi and Martens 1987; Gregory and Northcote 1993). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity (35-150 NTU) accelerate foraging rates among juvenile chinook salmon, likely because of reduced vulnerability to predators (camouflaging effect).

When the particles causing turbidity settle from the water column, they contribute to sedimentation. Sedimentation can cause the following effects: (1) buried salmonid eggs or embryos may be smothered and suffocated, (2) prey habitat may be displaced, and (3) future spawning habitat may be displaced (Spence *et al*. 1996). Additionally, turbidity and subsequent sedimentation can affect the quality of stream substratum as spawning material, influence the exchange of streamflow and shallow alluvial groundwater, depress riverine productivity, and contribute to decreased salmonid growth rates (Waters 1995; Newcombe and Jensen 1996).

The type of dredging equipment used would significantly influence turbidity levels. The COE is proposing the use of two types: mechanical and hydraulic. Mechanical dredging involves a clamshell, scoop, shovel or other device that removes sediments by excavation. Mechanical dredging has the potential to create turbidity primarily where the excavation is occurring as the interface between the excavating apparatus and sediments is not contained. Some mechanical devices are designed to avoid releasing sediments during transportation through the water column, thus limiting turbidity to the excavation phase of the dredging. Hydraulic dredging involves suction devices that remove sediments by liquefying them and then transporting them in a contained tube or other apparatus to a disposal or transportation site such as a barge. Hydraulic dredging typically generates less turbidity than mechanical dredging as the majority of mobilized sediments are captured by suction. However, the dewatering process that is associated with hydraulic dredging could reintroduce significant amounts of sediments and cause additional turbidity.

It is expected that turbidity resulting from dredging and dredged material disposal would be intense in the vicinity of the activity themselves, but would rapidly attenuate with time and space. The COE would implement a number of techniques to minimize turbidity effects resulting from project operations. First, the COE would monitor turbidity levels and modify dredging operations to avoid prolonged negative effects (see Section 1.3). Second, the COE would complete the majority of dredging and disposal operations during a period when listed salmonids are not abundant. Of the listed ESUs, only SRF chinook (adults, and possibly stream type juveniles) and SR steelhead (adults) would be present in the action area during this work window. Third, the COE would attempt to dispose silts in a manner to limit their exposure to listed fish - ensuring that no in-water disposal site receives more than 30 percent silt. Finally, the COE would use best management practices at disposal locations to prevent remobilization of sediments, and subsequent turbidity, through dewatering activities or storage.

2.1.3.1.2 Suspension of Contaminants

Disturbing benthic sediments through dredging and in-water disposal could mobilize and distribute a variety of contaminants. The COE has identified PAHs, organophosphates, chlorinated herbicides, ammonia, oil, grease, glyphosate, ampa, dioxin, heavy metals, and others as potential contaminants. Some of these contaminants may be acutely or chronically harmful to salmonids (Allan and Hardy 1980). However, many have unknown effects on salmonids or lack defined regulatory exposure criteria (Ewing 1999).

The degree to which contaminants would be suspended during dredging and in-water disposal, and the effects of the contaminants on listed salmonids are not clear. The COE has tested sediments for contaminants across the majority of areas where dredging is proposed. The COE has not found contaminants in concentrations that exceed existing regulatory criteria. However, regulatory criteria have not been designated for all contaminants or life history events that may be relevant to listed salmonids.

Another area of uncertainty is how dredging or in-water disposal actually distributes contaminants. If the dredging equipment contains the sediments effectively after excavation or suction, the distribution of contaminants would be greatly minimized. Conversely, if contaminated sediments are not contained effectively, they could be widely distributed. This is the primary concern with in-water disposal activities. In-water disposal would involve dumping sediments directly from a barge into the water, potentially resuspending any contaminants present. The COE, however, has tested sediments within most of the action area and determined that they would not, with the exception of silty substrates, exceed existing regulatory thresholds for a range of contaminants. The COE has determined that most contaminants are bound to fine particulate sediments (e.g., silt) and, therefore, will limit the extent to which they are disposed in water.

If contaminants are released during dredging or disposal activities, their effects may be subtle and difficult to directly observe. The effects of bioaccumulation are of particular concern as pollutants can reach concentrations in higher trophic level organisms (e.g., salmonids) that far exceed ambient environmental levels (Allan and Hardy 1980). Bioaccumulation may therefore cause delayed stress, injury or death as contaminants are transported from lower trophic levels (e.g., benthic invertebrates or other prey species) to predators long after the contaminants have entered the environment or food chain. It follows that some organisms may be adversely affected by contaminants while regulatory thresholds for the contaminants are not exceeded during measurements of water or sediments.

Exposure to sublethal levels of contaminants may have serious implications for salmonid health and survival. Recent studies have shown that low concentrations of commonly available pesticides may induce significant sublethal effects on salmonids. Scholz *et al.* (2000) and Moore and Waring (1996) have found that diazanon interferes with a range of physiological biochemical pathways that regulate olfaction and, consequently, homing, reproductive and anti-predator behavior of salmonids. Waring and Moore 1997 also found that the carbamate, carbofuran, had significant effects on olfactory mediated behavior and physiology in Atlantic salmon (*Salmo salar*). Ewing (1999) reviewed scientific literature on the effects of pesticides on salmonids and identified a wide range of sublethal effects: impaired swimming performance, increased predation on juveniles, altered temperature selection behavior, reduced schooling behavior, impaired migratory abilities, and impaired seawater adaptation.

Other non-pesticide compounds that are common constituents of urban pollution and agricultural runoff also adversely affect salmonids. Exposure to chlorinated hydrocarbons and aromatic hydrocarbons causes immunosuppression and increased disease susceptibility (Arkoosh *et al.* 1998). In areas where chemical contaminant levels are elevated, disease may reduce the health and survival of affected fish populations (Arkoosh *et al.* 1998). Throughout the lower SR, high concentrations of ammonia have been found in areas where fine sediments (silt) are prevalent (COE 2001). Because ammonia is so common in fine sediments, it is expected that ammonia would be a primary concern during dredging and disposal operations. Ammonia is toxic to fish - especially when the pH is relatively high (above 7.5) as is the case in the SR (COE 2001). However, ammonia does not have bioaccumulation potential common to fat soluble organic compounds.

As noted above, there is a growing body of literature that suggests small amounts of certain contaminants may affect the biology of salmonids. At present, regulatory thresholds are likely inadequate to account for these effects (i.e., some contaminants do not have salmonid exposure criteria or bioaccumulation criteria). It is expected that exposure criteria will be refined and expanded in the future.

In the meantime, the COE has committed to conservation measures that minimize the exposure of listed salmonids to contaminants: (1) the COE would conduct major dredging and disposal activities during the winter when listed salmonids are not abundant. Of the listed ESUs, only SRF chinook (adults, and possibly stream type juveniles) and SR steelhead (adults) would be present in the action area during this work window, (2) the COE would continue to sample sediments for contaminants and refrain from disposing of contaminated sediments in-water, (3), In no case, will an in water disposal area receive more than 30 percent silt. More typically, as is proposed at the Chief Timothy HMU site, shallow water habitats will be enhanced by adding sand and the silts will be reserved for capping the riparian bench, (4) the COE would implement BMPs to prevent fuels spills, hydraulic leaks, etc. during dredging and disposal operations, and (5) the COE would continue to monitor scientific literature to update/determine which chemicals adversely affect listed salmonids, at what concentrations the effects occur, and which means of sampling are most appropriate for specific contaminants.

In the future, the COE would also be responsible for utilizing sediment monitoring data and the results of additional scientific studies, in an adaptive management context, to refine operations under DMMP to minimize harm to listed species from contaminant exposure to the maximum extent practicable.

2.1.3.1.3 Entrainment and Harassment

Dredging devices have the potential to capture or entrain juvenile salmonids or embryos. Mechanical and hydraulic dredging techniques each pose some risk. Mechanical dredging is most likely to affect non-mobile salmonids (i.e., early life history stages), while hydraulic techniques could conceivably capture both non-mobile and mobile juvenile salmonids. Previous dredging activities in the SR have resulted in entrainment of listed chinook: developing embryos and alevins were accidentally collected in a mechanical dredging operation that took place downstream of the Lower Monumental Dam in 1992 (COE 1992).

The COE has committed to a number of conservation measures to reduce the probability of entrainment occurring during future dredge operations. First, the majority of dredging activities would be accomplished using mechanical means. Mechanical dredging would minimize the risk posed to swimming juveniles. Hydraulic dredging would only be performed in areas where the water temperature is at or exceeds 70 degrees Fahrenheit (rearing fall chinook appear to avoid temperatures greater than 70 degrees Fahrenheit (Easterbrooks 1995-1998)). Second, the COE has committed to thoroughly survey areas where redds are likely to occur (e.g., immediately below dams) prior to dredging, and then dredge around or otherwise avoid the redd if encountered. Third, the COE would complete dredging operations in winter when listed salmonids are not expected to be abundant. Of the listed ESUs, only SRF chinook (adults, and possibly stream type juveniles) and SR steelhead (adults) would be present in the action area during this work window.

NOAA Fisheries believes the probability of entrainment of adult steelhead is very low, and the probability of entraining adults of other listed species under NOAA Fisheries jurisdiction is zero. NOAA Fisheries believes further that the number of juvenile SRF fall chinook likely to be entrained is low, and that it is likely that no juveniles of other listed species would be entrained. Finally, NOAA Fisheries expects that SRF chinook and SR steelhead will be only nominally affected be the act of avoiding dredging operations. The conservation measures to be implemented by the COE sufficiently address the situations where entrainment and harassment are likely to occur.

2.1.3.1.4 Removal/Alteration of Spawning Habitat

As mentioned previously, SRF chinook spawning habitat had been substantially reduced by the development of the Federal hydro power system. SRF chinook spawning has been documented near lock entrances at SR dams (COE 2001), but it is not known if such spawning is successful. It is probable that shipping traffic through the locks substantially reduces the viability of SRF chinook redds constructed there. Clearly, it is not desirable from a fish management perspective for listed fish to spawn at lock entrances. Dredging of these sites is likely to reduce their suitability as spawning habitat, and, in turn, the amount of spawning that will occur in these areas.

The COE has not committed to the enhancement or creation of SRF chinook habitat elsewhere in the action area, but has expressed an interest doing so. They have committed to ensure that dredging operations do not adversely affect existing SRF chinook redds over the life of the DMMP.

2.1.3.1.5 Fill of Shallow Water Habitat

The creation of the riparian planting bench at the Chief Timothy HMU site would entail filling 18 acres of shallow water habitat. Substrate within the affected area is almost uniformly silt (COE 2002), a substrate type not preferred by listed ESUs in the action area (Bennett *et al*.1997). Sediment disposal plans for the site also include capping approximately 16 acres of silty substrate with a mantle of sand, thereby increasing the suitability of the this acreage as SRF rearing habitat. Further, the channel encroachment created by the planting bench is expected to slightly increase local water velocities which should encourage the further replacement of silty substrates with larger, more preferred substrate particle sizes.

The COE has committed to a number of conservation measures that would minimize or avoid impacts to shallow water habitat within the action area. First, the subject site supports only low quality rearing habitat. While roughly 18 acres will be filled, the proposed action would substantially enhance roughly 16 acres of poor quality rearing habitat. Second, the COE has committed to an adaptive management program for the enhancement of shallow water habitat throughout the action area over the life of the DMMP. Therefore, the short and long term loss of this low quality habitat is expected to be offset by short and long term gains in habitat quality proximal to the lost habitat and by long term gains in rearing habitat quality and quantity within the action area. Third, the creation of the riparian planting bench is expected to contribute a more complex array of food items over the long term. Taken in combination, these conservation measures should more than offset the adverse effects of filling shallow water habitat at the Chief Timothy site.

2.1.3.1.5 Alteration of Benthic Habitat

Dredging would remove some quantity of benthic salmonid habitat. The proposed in-water disposal plan also has to potential to create shallow-water benthic habitat.

Within the footprint of dredging operations, benthic habitat features would be physically removed. One impact of this habitat removal would be the temporary loss of some potential prey species (invertebrates) and their habitat. Aquatic invertebrates, particularly dipterans, are an important food item of juvenile chinook salmon and steelhead in the Lower SR (Bennett and Shrier 1986, Curet 1994).

The majority of dredging would focus on navigation lanes where oligachaetes and chironomids (dipterans) are the dominant invertebrates. Populations of these invertebrates are not likely to be substantially affected by dredging operations as they occupy habitat types that are prone to disturbance under natural conditions. Post-dredging recolonization would likely occur rapidly through drifting and crawling from adjacent non-disturbed areas (e.g., Mackay 1992). Because the dredging would focus mainly on a relatively narrow portion of the river bed (navigation lanes), and because the dredging itself would not render these areas unsuitable for oligachaetes and chironomids, the temporary loss of invertebrate habitat is unlikely to limit food production or significantly affect foraging opportunities within the reservoirs.

Dredging may also disrupt complex nearshore rearing habitats by physically removing them. Rearing habitats include functional elements such as foraging areas, thermal and velocity refugia, cover, and food. Bennett (1997) identified shallow sandy, nearshore areas as important rearing areas for juvenile fall chinook in the lower SR. Zimmerman and Rasmussen (1981) and Easterbrooks (1995-1998) found that chinook salmon also rear in some low velocity, vegetated backwater areas of the CR (e.g., Casey Ponds). Although these types of habitat are not common throughout most of the dredging footprint (navigation lanes), they may exist near boat basins, swimming beaches, or boat launches (COE 2001).

To reduce the adverse affects of habitat alteration that may occur through dredging, the COE proposes to construct nearshore rearing habitat through dredged material disposal. The goal of this habitat construction would be to mimic the shallow, sandy rearing conditions favored by some fall chinook juveniles (Bennett *et al.* 1997). This type of habitat has been successfully constructed following previous dredging operations (Bennett *et al.* 1997). The creation of rearing habitat with dredged materials is a promising prospect that may replace habitat functions lost as a result of dredging activities.

2.1.3.2 Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur (50 C.F.R. § 402.02). Indirect effects can occur outside of the area directly affected by the action. Indirect effects can include other Federal actions that have not undergone Section 7 consultation but will result from the action under consideration. These actions must be reasonably certain to occur, or they are a logical extension of the proposed action. The indirect effects that would result from the proposed implementation of the DMMP include: (1) continued anthropogenic sedimentation of the action area, and (2) continued dredging, and the attendant effects thereof beyond the term of the DMMP.

2.1.3.2.1 Anthropogenic Sedimentation.

It is believed that dredging interacts with sediment erosion and deposition in the SR Basin. Initial work by Reckendorf and Pedone (1989) implicates erosion from forestry and agricultural practices as major contributors of sediment to the Snake and Clearwater Rivers. Because maintenance of the navigation channel is critical to sustaining agricultural production, as well as other industries within the basin (through maintenance of inland shipping routes), it can be argued that the effects of these industries to listed fish are to some extent an indirect effect of maintenance dredging.

Dredging provides a functional navigation system along the slack waters of the lower SR and downstream to the Columbia River and Pacific Ocean. This navigation system provides shippers a means of transporting goods to and from inland ports. According to the COE (2001) wheat, barley, wood chips, and other wood products are the primary commodities bound downstream while petroleum and fertilizer are the primary commodities bound upstream. The COE (2001) has determined that these shipments depend on the availability of a navigation system that provides a 14-foot draft channel for barge tows.

The predominance of agricultural commodities (wheat, barley, fertilizer) in barge commerce indicates that this industry has strong economic interests in the maintenance of the navigation system. Barging appears to be a significant factor in determining the profitability of the major crops in the SRB. For instance, Jessup and Casavant (1998) determined that without river navigation above the Tri-Cities (at any time during the year), grain farmers and shippers would be adversely affected. In their analysis they compared scenarios where wheat and barley were transported using rail shipments instead of barge shipments. They estimated that transportation costs would increase, on average, 1 cent/bushel for wheat and 6.8 cents/bushel for barley when no constraints on the volume of rail shipments existed (cost increases are based on initial figures of 49.61 cent/bushel for wheat and 28.31 cent/bushel for barley). In the more likely scenario that rail capacity was constrained (110 percent of historical volume) average transportation costs increase 4.2 cents/bushel and 6.8 cents/bushel for wheat and barley, respectively. However, there would be some variation in the cost increase with some shippers experiencing little or no change in transportation costs and some shippers experiencing up to 7 cents/bushel for wheat and 13 cents/bushel for barley.

Moving agricultural products solely by truck instead of barging would also increase transportation costs. It costs approximately $800 to move a 47,000-pound container of lentils round-trip by truck between a load center in the Palouse and Portland's terminal 6. It costs approximately $350 round-trip to move the same container via truck and barge combination (Ellis 1999). It is not correct to assume that the agriculture industry exists solely because of the navigation system as it predated the installation of the mainstem dams on the Snake and

Columbia Rivers, but it is reasonable to assume that agricultural production levels are affected by the cost of shipping products and supplies (Jessup and Casavant 1998).

In this consultation, agricultural land use is particularly relevant to dredging because it is suspected to be one of the primary causes of sedimentation which, in turn, necessitates frequent dredging. Reckendorf and Pedone (1989) implicated agricultural land use in the Clearwater, Grande Ronde, and SRB as major anthropogenic sources of sediments. By dredging the navigation system, the COE may be enabling land use activities that contribute to sedimentation or the Lower SR reservoirs, and upstream habitats. If the navigation system is maintained, agricultural land use practices, and potentially sedimentation, would be expected to continue at a similar rate. Alternatively, if the navigation system were not maintained, agricultural activity might decline, resulting in a decrease in sedimentation.

While agriculture and other sediment producing activities benefit from the maintenance the navigation system on the Columbia and Snake Rivers, the specific land management practices employed in commodity production are not influenced by the navigation system. For example, the presence of the navigation system does not influence the type of tillage system employed by upstream farmers. In other words, implementation of the DMMP will contribute to increased sedimentation, but the amount of sedimentation will be determined by factors beyond the COE's control.

In that the COE is saddled with the task of dredging and redistribution of sediments originating outside of the action area, they have an interest in reducing the amount material that must be so handled. The COE intends to consult with the Local Sediment Management Group (LSMG), a group that includes representative of multiple Federal, state, and local agencies and entities, regarding the need for and potential scope of follow up studies to Reckendorf and Pedone (1989).
The COE intends to solicit the help of LSMG member organizations in conducting any such studies relating to activities under the control of member organizations. Further, the COE would seek authorization and appropriations to conduct a general investigation study on issues they determine to be related to activities under their control.

2.1.3.2.2 Altered Channel Morphology

As mentioned previously, the levee system in the Lewiston/Clarkston vicinity is designed to provide flood protection up to a 100 year flood. Raising the levees three feet in order to achieve protection for up to a 400 year flood could, in the event of such a flood, contribute to changes in local channel morphology. However, the effects to local channel and habitat conditions would likely be insignificant as compared to the habitat changes that would occur throughout the area affected by such a flood. Therefore, the three foot levee raise is not expected to adversely affect listed species.

2.1.3.3 Population Level Effects

As described in Section 2.1.2.2, NOAA Fisheries has estimated the median population growth rate (lambda) for each species potentially affected by the implementation of the DMMP. The proposed action would seasonally increase turbidity and the risk of contaminant exposure local to dredging and disposal operations over the life of the DMMP. Dredging may result in the entrainment of a small number of fall chinook (i.e., those employing a stream type life history), and material disposal would destroy 18 acres of low quality shallow water rearing habitat at the Chief Timothy HMU site. However, the effects of the proposed action will be minimized through timing, disposal technique, extensive monitoring, adaptive management, and equipment selection. Further, the use of dredge spoils to enhance shallow water and riparian habitat has the potential to more than offset the loss of filled habitat and the disturbance of benthic habitats as anticipated in the proposed action. The remainder of the proposed disposal sites are either upland or sites that are not presently believed support SRF chinook rearing. Taking all these factors into account, NOAA Fisheries does not believe that the proposed action is likely to influence existing population trends or risks for NOAA Fisheries' listed species within the action area.

2.1.3.4 Effects on Critical Habitat

The NOAA Fisheries designates Critical Habitat for a listed species based upon physical and biological features that are essential to that species. Essential features of Critical Habitat for endangered SR sockeye, threatened SRF chinook, and threatened SRSS chinook, include substrate, water quality/quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions (58 Fed. Reg.68543, December 28, 1993).

As discussed previously, implementation of the DMMP would cause both transient and longer term impacts to Critical Habitat. Transient effects, including turbidity and the resuspension of contaminants, will occur largely concurrent with dredging and in-water disposal activities. In terms of the essential features of Critical Habitat, turbidity and contaminants may decrease water quality and food availability.

Longer term effects include the alteration and removal of substrate suitable for SRF chinook spawning, alteration of benthic habitat, and the filling of shallow water habitat. As mentioned previously, SRF chinook have been documented spawning near and within navigation lock entrances. It is not known whether spawning in these areas has been successful, but, in that redds so located would be at risk of damage from boat traffic, it is not desirable that SRF chinook spawn there. While the COE proposes to dredge areas that may contain suitable spawning gravels, they will avoid damaging known redds. It will be important to assess other options for SRF chinook spawning habitat enhancement. Removing benthic habitat during dredging will decrease the abundance of some food items for perhaps a year or two and may impact the quality of certain rearing areas. However, the COE proposes to construct and enhance shallow water rearing habitat at multiple sites. The loss of rearing habitat functions (e.g. food production, foraging areas, temperature and velocity refugia) that may result from dredging are likely to be replaced by constructed and enhanced habitat. Further, the establishment of riparian vegetation at the Chief Timothy site would likely increase the diversity and quantity of food items available over the long term.

It appears that dredging may have an indirect influence on sedimentation by helping to maintain the economic viability of industries whose land use practices cause high levels of anthropogenic sedimentation. The COE would work with the LSMG to determine the need for and extent of additional investigations into sediment sources. The COE would also cooperate with LSMG member organizations on studies relating to activities or geography under the jurisdiction of member organizations. Finally, the COE would seek authorization and appropriations to conduct a general investigation study of sedimentation issues it determines to be under its control.

When all of the above factors are considered, it does not appear as though the proposed action is likely to diminish the value of essential features of Critical Habitat to the detriment of survival or to a point that would impede the recovery of listed fish. Consequently, the implementation of the DMMP (2002-2003 project operations and 20 year conceptual plan) would not adversely modify the Critical Habitat of SR sockeye, threatened SRF chinook, or threatened SRSS chinook.

2.1.4 Cumulative Effects

Cumulative Effects are defined in 50 C.F.R. § 402.02 as "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." For this analysis, cumulative effects for the general action area are considered. Future Federal actions, including the ongoing operation of hatcheries, fisheries, and land management activities have been or will be reviewed through separate Section 7 consultation processes.

Throughout the action area, much of the land is likely to remain rural and used for agricultural purposes. However, most arable lands have been developed and water resource development has slowed in recent years. Increasing environmental regulations and diversification in local economies has reduced some impacts that have been previously associated with water and land use by agriculture and extractive industries.

The State of Washington has also implemented a number of strategies to improve habitat for listed species. The 1998 Salmon Recovery Planning Act provided the framework and a funding mechanism for developing watershed restoration projects. It also created the Governor's salmon Recovery Office to coordinate and assist in the development of salmon recovery plans. Washington's "Statewide Strategy to Recover Salmon," for example, is designed to improve watersheds (NMFS 2000).

The Watershed Planning Act, also passed in 1998, encourages voluntary planning by local governments, citizens, and Tribes for water supply and use, water quality, and habitat at the Water Resource Inventory Area or multi-Water Resource Inventory Area level. Grants are made available to conduct assessments of water resources and to develop goals and objectives for future water resources management. The Salmon Recovery Funding Act established a board to localize salmon funding. The board will deliver funds for salmon recovery projects and activities (NMFS 2000).

WDFW and tribal co-managers have been implementing the Wild Stock Recovery Initiative since 1992. The co-managers are completing comprehensive species management plans that examine limiting factors and identify needed habitat activities. The plans also concentrate on actions in the harvest and hatchery areas, including comprehensive hatchery planning. The department and some western Washington treaty Tribes have also adopted a wild salmonid policy to provide general guidance to managers on fish harvest, hatchery operations, and habitat protection and restoration measures to better protect wild salmon runs (NMFS 2000).

Water quality improvements may result from the development of total maximum daily load restrictions (TMDL) for a range of pollutants. The state of Washington is under court orders to develop TMDL management plans for each water body listed as water quality limited under Section 303 (d) of thee Clean Water Act. It has developed a schedule that is updated yearly; the schedule outlines the priority and timing of TMDL plan development (NMFS 2000).

Washington State withdrew the water of the mainstem CR from further appropriation in 1995. Currently, all applications for new water withdrawals are being denied based on the need to address ESA issues. The state established and funds a program to lease or buy water rights for instream flow purposes. This program was started in 2000 and is in the preliminary stages of public information and identification of potential acquisitions. These water programs, if carried out over the long term, should improve water quantity and quality in the state (NMFS 2000). However, there is significant pressure within the state to begin appropriating water directly from the Columbia and Snake Rivers and from local aquifers that may be hydraulically connected to the Columbia. Within this paradoxical dynamic, it is difficult to predict long term trends in water quantity and quality.

2.1.5 Conclusion/Opinion

NOAA Fisheries' jeopardy analysis is based upon the present status of the species, environmental baseline within the action area, and the effects of the proposed action. The analysis takes into account the species' status because determining the effect upon a species' status is the essence of the jeopardy determination. Depending on the specific considerations of the analysis, actions that are found likely to impair presently properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat towards properly functioning condition at the population or ESU scale will generally be determined likely to jeopardize the continued existence of listed salmon, adversely modify critical habitat, or both. Specific considerations include whether habitat condition was an important factor for the decline in the listing decision, changes in population or habitat conditions since listing, and any new information that has become available.

NOAA Fisheries has determined that the effects of the proposed action will not jeopardize the continued existence of SR sockeye, SRF chinook, SRSS chinook, SR steelhead, UCRS chinook, UCR steelhead, or MCR steelhead. The proposed action is not expected to degrade baseline habitat functions necessary for the survival and recovery of any of the subject species. The action would cause transitory turbidity and increase the probability of injury or death through entrainment, but these effects would not affect long-term baseline habitat functions. The proposed action would also mobilize contaminants, potentially injuring or killing listed fish. Existing regulatory thresholds are probably inadequate to account for the range of contaminant-related impacts that may affect listed salmonids in the action area. However, the COE would minimize exposure risks through conservation measures and by adopting an adaptive management strategy to which DMMP operations would be responsive.

Implementation of the DMMP would remove some benthic habitat and fill 18 acres of shallow water habitat. However, virtually all of that 18 acres is judged to be poor quality rearing habitat. Further, the proposed action includes plans to enhance existing and create additional shallow water rearing habitat. These techniques have been used previously by the COE, and SRF chinook were shown to utilize enhanced habitats. The proposed action will also remove relatively small amounts of gravels and cobbles in areas (near and within navigation lock entrances) where SRF chinook have spawned in some years. This action may modify site conditions to the point that SRF chinook no longer spawn in these areas. As mentioned previously, it is not known if such spawning is successful, but redds so located are believed to be at substantial risk or damage from barge traffic. The indirect effects of the proposed action also include anthropogenic sedimentation. The COE has committed to better understand this issue and is willing to attempt to address the problem as described previously.

Overall, the direct and indirect effects attributable to the proposed action are not expected to degrade the environmental baseline to the extent that the survival and recovery of listed salmonids would be compromised. NOAA Fisheries relied on the best scientific and commercial information available in making this determination. Despite the effects described above, the proposed action is unlikely to influence present population trends or risks. Accordingly, at no time, and without contingencies, will the activities described in this BO cause levels of take or destroy habitat that would appreciably reduce the likelihood of survival and recovery of the subject listed species.

2.1.6 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or action area, to help implement recovery plans, or to develop additional information.

To reduce the cumulative effects of sedimentation and dredging within the action area, NOAA Fisheries recommends that the COE coordinate and collaborate with other state and Federal agencies to use their collective authorities to address anthropogenic erosion problems upstream of the action area. NOAA Fisheries further recommends that this effort include measures to reduce contaminant loads, ammonia in particular, associated with sedimentation. The COE will seek authorization and appropriations to conduct a general investigation study on issues that the COE determines relate to activities and/or areas within its control.

To reduce the cumulative effects of the loss of SRF chinook spawning habitat with the action area, NOAA Fisheries recommends that the COE explore opportunities to create spawning habitat away from the navigation channel and lock facilities.

NOAA Fisheries requests notification of the implementation of any conservation recommendations.

2.1.7 Reinitiation of Consultation

Consultation must be reinitiated if (1) the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; or (3) a new species is listed or Critical Habitat is designated that may be affected by the action (50 C.F.R.§ 402.16). The COE must monitor the implementation of listed reasonable and prudent measures and terms and conditions of the incidental take statement. The COE must reinitiate consultation if elements of the proposed project are implemented in a manner that is inconsistent with, or deviates from, the terms and conditions of this consultation. To reinitiate consultation, the COE must contact the Habitat Conservation Division (Washington Branch Office) of NOAA Fisheries.

2.2 Incidental Take Statement

Section 9 of the ESA and Federal Regulation pursuant to Section 4 (d) of the Act prohibit the take of endangered and threatened species without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as spawning, rearing, feeding, and migrating (50 C.F.R. § 222.106; 64 Fed. Reg. 60727; November 8, 1999). Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or applicant carrying out an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and is not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary; in order for the exemption in Section 7(o)(2) to apply, they must be implemented by the action agency. The COE has a continuing duty to ensure that the action is implemented in accordance with this incidental take statement. If the COE fails to comply with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and set forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

2.2.1 Amount or Extent of the Take

The NOAA Fisheries anticipates that incidental take of SR sockeye, threatened SRF chinook, threatened SRSS chinook, threatened SR steelhead, endangered UCRS chinook, endangered UCR steelhead, and threatened MCR steelhead is reasonably certain to result from project activities as described in the BO. Despite the use of the best scientific and commercial data available, NOAA Fisheries cannot estimate a specific amount of incidental take of individual SR adult steelhead, SRF chinook juveniles, embryos, or incubating eggs, but estimates the amount of incidental take of other NOAA Fisheries listed species at near zero. The mechanisms and extent of expected effects are summarized below.

The NOAA Fisheries believes that there are several mechanisms by which take would occur. Direct harm or injury may result from dredging actions or inwater disposal where turbidity is generated, contaminants are mobilized, or dredging equipment entrains fish. Indirect harm, through long term habitat modification could occur by the physical removal of benthic habitat during dredging, by the filling of shallow water habitat, or by frequent dredging to address anthropogenic sedimentation. Indirect harm could also result if the conservation measures and reasonable and prudent measures described in this BO are disregarded.

The extent to which these mechanisms can result in effects on listed salmonids, or their habitat, can be described qualitatively, enabling reinitiation of consultation if such effects are exceeded during the project. The following descriptions indicate the action that could potentially cause take and the threshold value(s) or condition where take would exceed levels anticipated by this consultation: (1) In water work (i.e., the risk of turbidity, contaminant mobilization, and entrainment) would only occur during winter work windows or when water temperatures exceed 70 degrees Fahrenheit, (2) Hydraulic dredging (i.e., risk of entrainment) would only occur when water temperatures exceed 70 degrees Fahrenheit, (3) No in-water disposal site (i.e., risk of turbidity and contaminant mobilization) would receive more than 30 percent silt, and the COE will attempt to use silts in a manner (e.g., capping for riparian bench) that minimizes exposure of listed fish to silts, (4) Redd surveys would be conducted prior to dredging (i.e., risk of entrainment) in potential spawning areas, (5) Dredging would be limited to the footprints described in this BO -conveyance/capacity dredging would not occur (i.e. risk of long term habitat degradation.)

2.2.2 Reasonable and Prudent Measures

The NOAA Fisheries believes that the following reasonable and prudent measures (RPMs) are necessary and appropriate for minimizing take of SR sockeye, threatened SRF chinook, threatened SRSS chinook, threatened SR steelhead, endangered UCRS chinook, endangered UCR steelhead, and threatened MCR steelhead

1. The COE will minimize take of listed species through implementing conservation measures.

2. The COE will monitor DMMP operations to minimize take.

3. The COE will adaptively manage DMMP operations to minimize take.

4. The COE will minimize take by conducting DMMP activities so that they do not contribute to anthropogenic sedimentation.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of Section 9 of the ESA, the COE must comply with the following Terms and Conditions, which implement the Reasonable and Prudent Measures described above. These terms and conditions are non-discretionary.

1. Implement RPM No. 1 by conducting the following

   1.2 In-water work will occur in prescribed work windows (December 15 through March 1 in the Snake and Clearwater Rivers, and December 1 to March 31 in the Columbia River). Hydraulic dredging may occur outside of these windows but only when water temperature in the area to be dredged exceeds 73 degrees Fahrenheit. While juveniles SRF chinook have been show to avoid water temperatures greater than 70 degrees Fahrenheit, in-water work will be delayed until water temperature exceeds 73 degrees Fahrenheit to ensure there are no SRF chinook in the area. Hydraulic dredging will only occur at the boat basins, swim beaches, and irrigation intakes listed in Section 1.3.1.1 of this BO.

   1.2 No in-water disposal site will receive more than 30 percent silt. The COE will further attempt to dispose silts in a manner that minimizes exposure risks to listed fish.

   1.3 Dredging at lock approaches will only occur after redd surveys have been conducted.

2. Implement RPM No. 2 by conducting the following

   2.1 In accordance with the project description provided in Section 1.3 of this BO, water quality and sediment contaminant monitoring will be performed in accordance with the Lower Columbia River Dredged Material Evaluation Framework (DMEF) (COE *et al* 1998). Specific concerns at any given dredging or disposal site should be addressed with site specific monitoring after the dredging or disposal has occurred.

   2.2 In areas where contaminant analyses have yet to be performed, a randomized, non-biased sampling design will be implemented for sample collection. In accordance with the joint EPA/COE guidance presented in the DMEF, tier I and tier II procedures will be used to determine where samples will be collected.

2.3 Surveys will be conducted at lock forebays to determine whether redds are present in the dredging footprint. If the surveys are inconclusive, because of environmental conditions or other factors, dredging will be postponed until a definitive survey can be made. If a redd is found in the dredging footprint, the COE will avoid harming it.

2.4 The COE will evaluate the benefits of newly constructed habitat/in-water disposal sites. Specifically, the COE will determine if new habitat locations function as intended -create rearing habitat for juvenile fall chinook.

2.5 To determine the potential impacts of DMMP operations in backwater areas (e.g., Joso barge slip, boat basins and swimming beaches), the COE will determine the spatial and temporal distributions of rearing salmonids, as well as identify key habitat attributes that explain the distributions within these areas..

3. Implement RPM No. 3 by conducting the following

3.1 The COE will use sediment contaminant analyses, the results of future studies, and future State and Federal regulations, where necessary, to avoid harming listed fishes. The DMMP and its operations will be updated or modified if new information or regulations are produced that indicate contaminant exposure criteria currently used by the COE are incorrect or insufficient to protect listed species.

4. Implement RPM No. 4 by conducting the following

4.1 The COE will bring the issue of anthropogenic sedimentation to the LSMG for further investigation concerning whether these industries still contribute significant quantities of sediment to the action area. If the LSMG determines that studies need to be conducted, the COE will cooperated with the agencies and entities on such studies within the limits of its authority.

3.0 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));

- NOAA Fisheries shall provide conservation recommendations for any Federal or State activity that may adversely affect EFH (§305(b)(4)(A));

- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.110). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies regarding any activity that may adversely affect EFH, regardless of its location.

The objective of this EFH consultation is to determine whether the proposed action may adversely affect designated EFH, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse impacts to EFH resulting from the proposed action.

3.2 Identification of Essential Fish Habitat

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: chinook (*Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*)(PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in

Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts to these species' EFH from the proposed action is based, in part, on this information.

3.3 Proposed Actions

The proposed action and action area are detailed above in Section 1.3 of the BO. The action area includes habitats that have been designated as EFH for various life-history stages of coho and chinook salmon.

3.4 Effects of Proposed Action

As described in detail in Section 2.1.3 of this BO, the proposed activities may result in detrimental short and long-term effects to a variety of habitat parameters. These adverse effects are:

3.4.1 Turbidity resulting from dredging and in-water disposal of dredged materials

3.4.2 Mobilization of potentially contaminated sediments into the water column.

3.4.3 Removal of benthic habitat through dredging.

3.4.4 Removal of spawning substrate through dredging.

3.4.5 Additional sedimentation that may be fostered by dredging activities.

3.4.6 Fill of 18 acres of low quality SRF chinook habitat at the Chief Timothy HMU disposal site.

3.5 Conclusion

NOAA Fisheries believes that the proposed action may adversely affect designated EFH for coho and chinook salmon.

3.6 EFH Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. The conservation measures proposed in the BA will substantially minimize the adverse effects to EFH described above. NOAA Fisheries does not believe, however that the conservation measures alone fully address these adverse effects. NOAA Fisheries recommends that the COE adopt the Reasonable and Prudent Measures and the Terms and Conditions outlined in Section 2.2.2 of the BO in addition to these conservation measures as EFH conservation measures. If implemented by the COE, this suite of measures will sufficiently minimize adverse effects to EFH.

3.7 Statutory Response Requirement

Please note that the MSA and 50 CFR 600.920(j) require the Federal agency to provide a written response to NOAA Fisheries' EFH conservation recommendations within 30 days of its receipt of this letter. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity. In the case of a response that is inconsistent with the EFH Conservation Recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The COE must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

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